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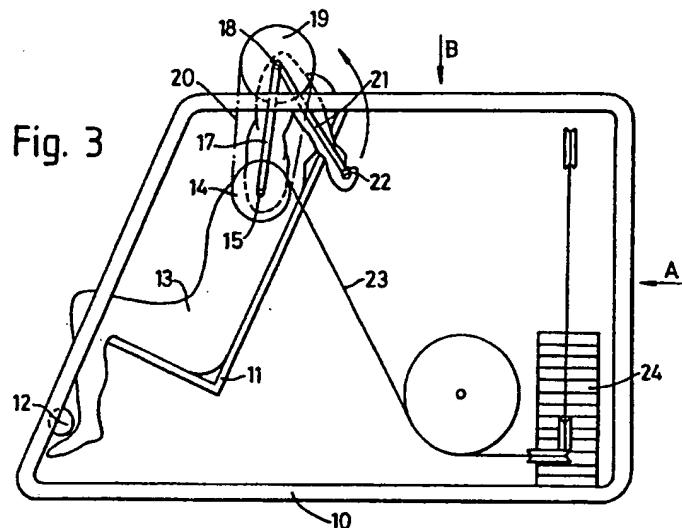
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## (54) Exercise machine

(57) An exercise machine devised to exercise the muscles associated with two adjacent joints, for example the shoulder and elbow or the hip and knee, comprises a support frame 10 and a first gear wheel 14 mounted for rotation about a first pivot 15 fixed relative to the frame. An elongated link 17 is pivoted at one end upon the first pivot and carries a second gear wheel 19 upon a second pivot 18 at its other end. The gear wheels are linked together by drive means, for example a chain 20, and a lever 21 is provided to rotate the second gear wheel. A resistance means 24 applies a load opposing rotation of 20, and a lever 21 is provided to rotate the second gear wheel. A resistance means 24 applies a load opposing rotation of the first gear wheel. When a user adopts a position in which his relevant joints correspond approximately to the positions of the respective gear wheels and then applies a pressure upon the lever, both of his joints are exercised. Preferably gears 14, 19, link 17, chain 20 and lever 21 are duplicated to allow both sides of the body to be exercised together.



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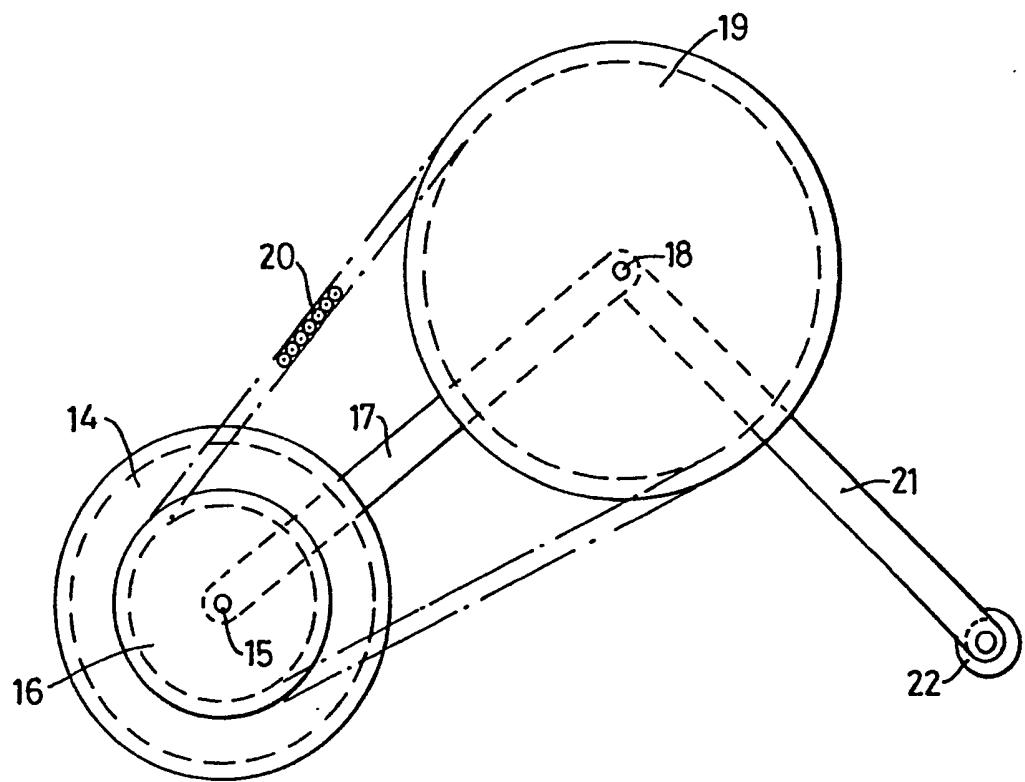


Fig. 1

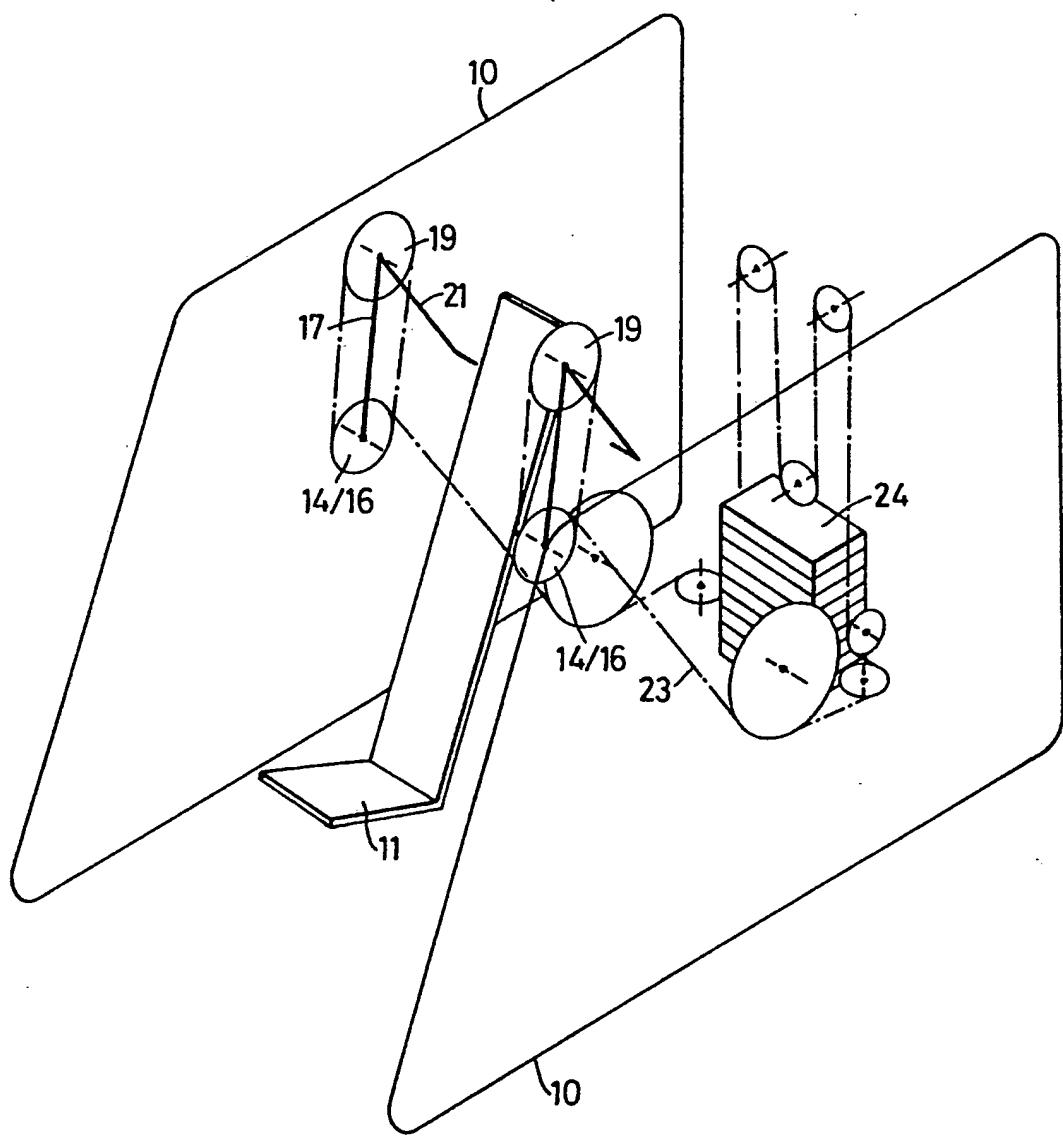


Fig. 2

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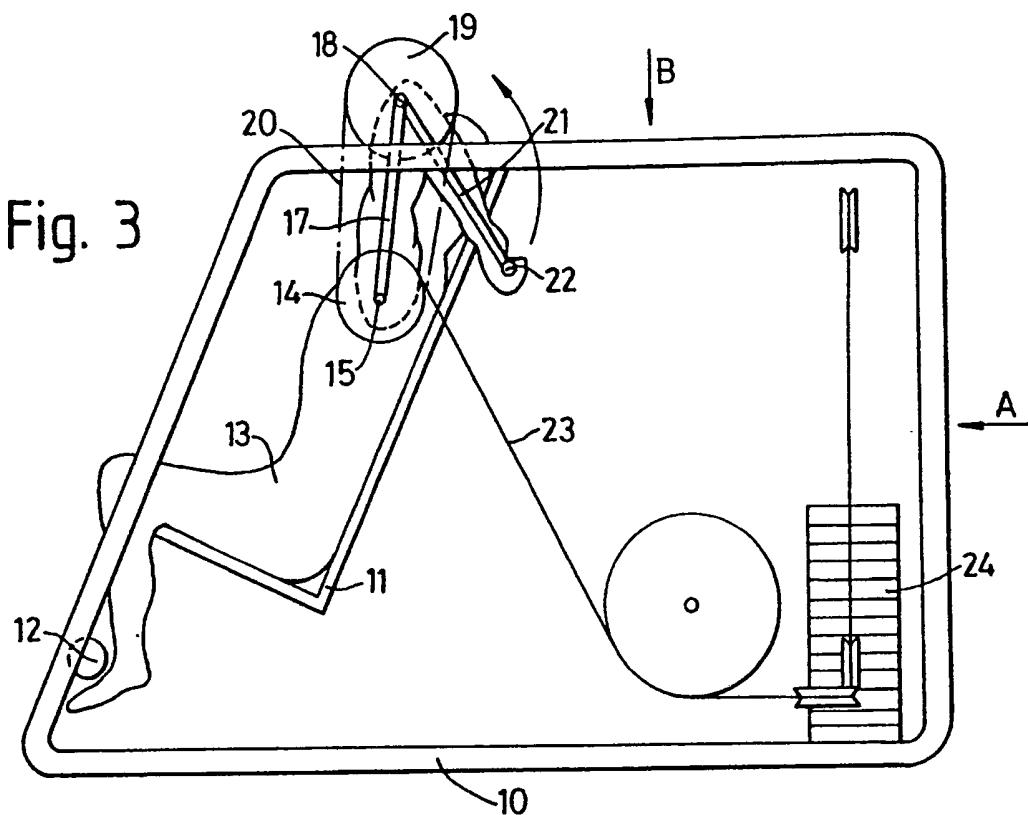


Fig. 3

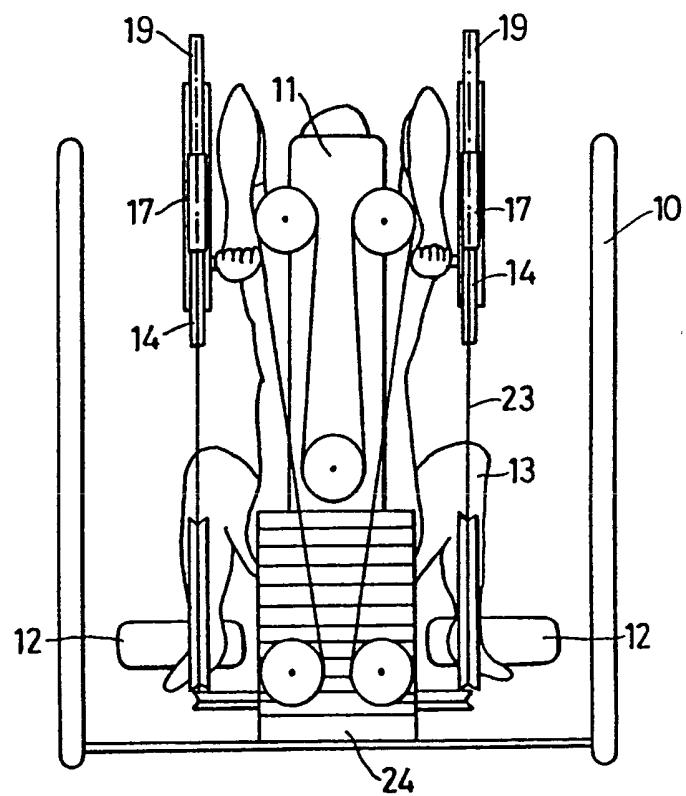


Fig. 4

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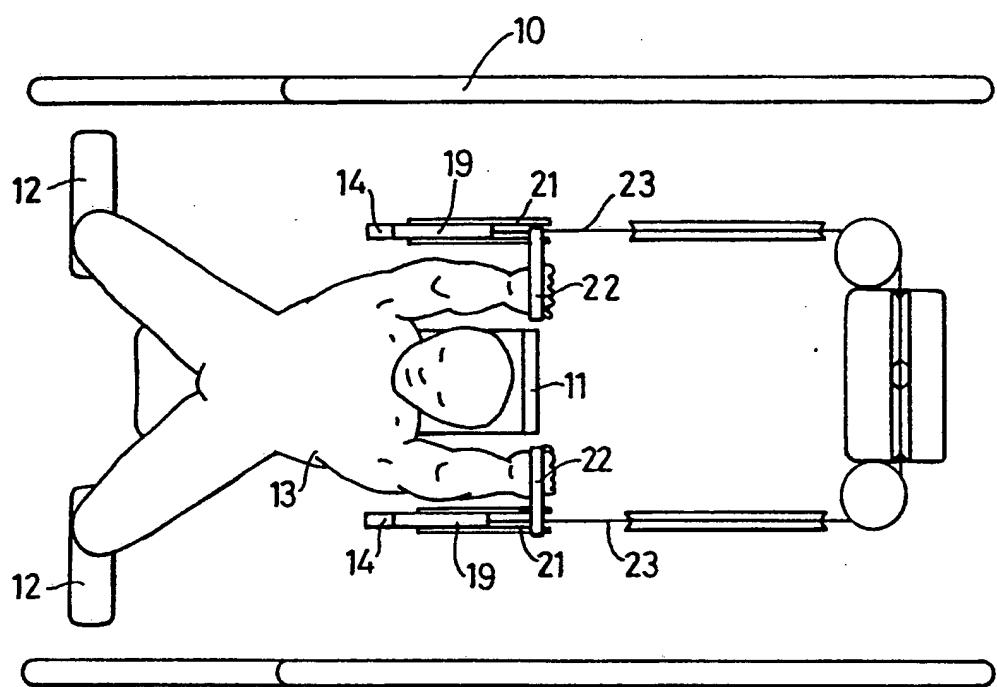
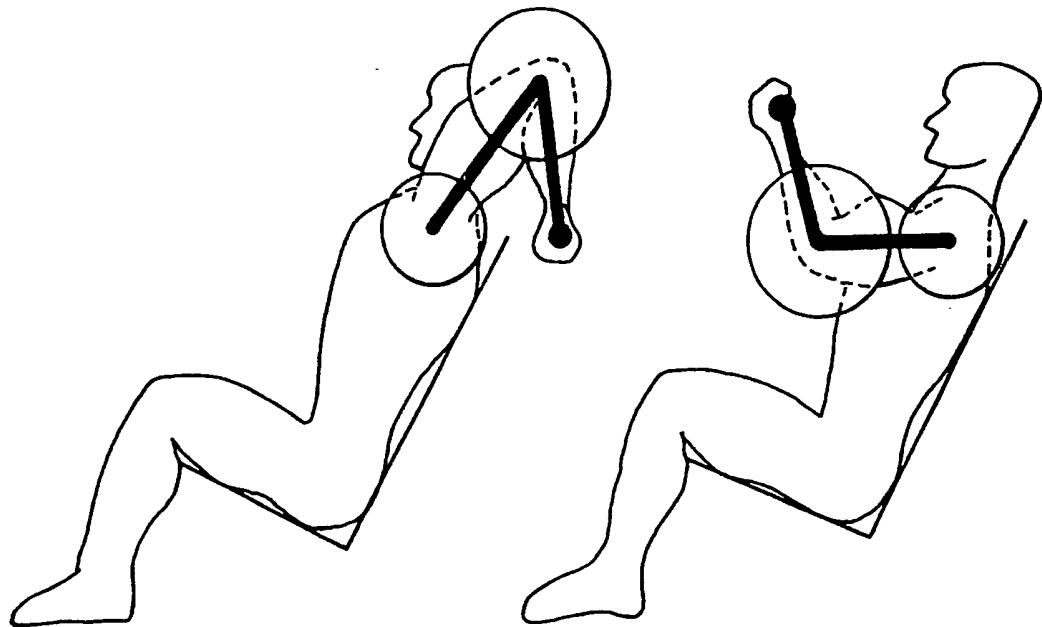


Fig. 5

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A. START-FINISH  
BICEPS CONTRACTED  
TRICEPS EXTENDED

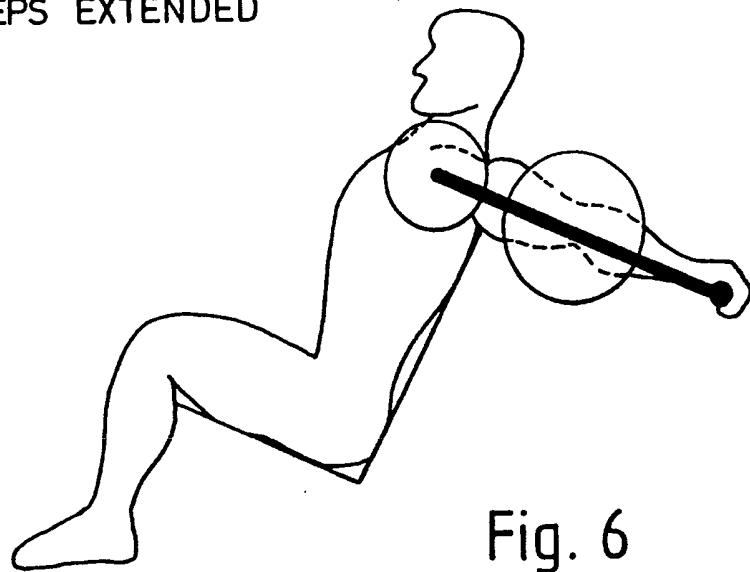


Fig. 6

C. FINISH-START  
BICEPS EXTENDED  
TRICEPS CONTRACTED

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Exercise Machine

The present invention is an exercise machine and in particular a machine devised to exercise the muscles associated with two adjacent joints.

5        Much current exercising to develop the body muscles is based on the use of weights. Weight training has the particular advantage that a selected course of different exercises can be adopted to enable the development of several different muscles of the body in simultaneous and/or successive actions. Numerous  
10      machines and other forms of exercise apparatus have been developed but most such machines are relatively specific in their effects, for example exercising a single joint (or usually the same joints on the two sides of the body) by a given exercise. For example machines for exercising the arm muscles tend to  
15      concentrate on action around the elbow joints and therefore may not adequately exercise those arm muscles which are associated with the shoulder joint. Similarly, exercise machines designed to develop the leg muscles may place too much emphasis on the knee joint, while inadequately exercising the muscles associated with  
20      the hip.

The proper stimulation of any muscle requires that it be

exercised throughout its full range of movement, that is from its fully extended position to its fully contracted position. Machines which place undue emphasis on the movement of a single joint usually fail to achieve such full stimulation of the

5 muscles.

For these reasons, the exercise machine according to the present invention has been devised to make possible the exercising of muscles at two adjacent joints with a single machine.

10 The exercise machine of the present invention comprises a support frame, a first gear wheel mounted for rotation about a first pivot which is fixed relative to the support frame, an elongated link pivoted in the region of one of its ends about said first pivot, a second gear wheel mounted for rotation about 15 a second pivot in the region of the other end of said elongated link, drive means linking the peripheries of the first and second gear wheels, a lever to rotate said second gear wheel about the second pivot, and resistance means to apply a load opposing rotation of said first gear wheel.

20 As will become apparent hereinafter, when the exercise machine is in use, the first and second pivots are located within the respective areas of two adjacent body joints, for example the shoulder and the elbow or the hip and the knee. Flexing of either joint is opposed by the resistance means 25 and the interlinking of the gear wheels ensures that both joints are involved in the exercise routine.

The machine may be designed to exercise the muscles at one side of the body only but most exercise machines operate on the two body sides symmetrically. It is much preferred that the machine according to the present invention be so constructed as to exercise both sides in this way and for this purpose, at least the first and second gear wheels, the elongated link and the lever will therefore be duplicated. However, for convenience, the following general description will refer to these components in the singular, it being understood that the components and mechanism of operation applied to one side of the body may, and preferably will, have counterparts on the other side also.

The support frame is preferably of generally open construction, for example formed of tubular or angled frame members. In a preferred form, a seat or other body support is disposed within the frame and mounted thereon, so that the user may adopt an appropriately-supported exercise position.

The first pivot is located at a position upon the frame which corresponds to that of the first joint of the user, especially his shoulder or hip, when he is supported within the frame. A first gear wheel is mounted for rotation about this first pivot.

Also pivoted upon the first pivot is an elongated link, which has the second pivot at its other end. The link has the function of supporting the two pivots in positions approximating to those of the two joints being exercised and its length is selected accordingly. That is, if the arm muscles are to be

exercised, then the length of the elongated link, measured between the pivots, should be about equal to the distance from shoulder to elbow of a selected or average user. Similarly, if the machine is designed to exercise the leg muscles, the 5 elongated link should correspond approximately in length to that of the user's thigh. Upon the free end of the elongated link, the second gear wheel is pivoted about the second pivot.

The peripheries of the two gear wheels are linked together by a drive means. Thus for example, a continuous flexible belt 10 may pass around the peripheries of the two gear wheels or the gear wheels may be linked directly by an intermediate gear. However it is particularly preferred that the gear wheels be linked by means of a drive chain, engaging teeth on the peripheries of the respective gear wheels.

15 The two gear wheels may have the same number of gear teeth on peripheries of equal length, thereby transmitting to the gear wheels an equal resistance to rotation. However the gear wheels may be differently sized in order to apply different loads to the muscles at the two joints. For example, particularly when 20 exercising the arm muscles, it is preferred that the second gear wheel be larger than the first, thus applying a greater load at the elbow joint than at the shoulder. For example the numbers of teeth and the lengths of the circumferences of the second and first gear wheels respectively may be in the approximate ratio 25 of 1.5:1.

Rotation of the second gear wheel about the second pivot is

effected by means of a lever operated by the user of the exercise machine. Thus means are preferably provided to assist the user to operate the lever. For example, the lever may be fitted with a hand grip or a foot bar at its free end.

5        The loading of the machine, that is the provision of the resistance against which the muscles to be exercised must work, takes the form of a resistance means opposing rotation of the first gear wheel. The resistance means may take the form of weights or a spring or may be hydraulically or pneumatically operated. Whatever the form of resistance means, it is much preferred that the load applied thereby be variable. In the most preferred form of the invention, the resistance means comprises one or more weights, conveniently operating via an arrangement of wire and pulleys directly to load the first gear wheel.

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Preferably the direction of resistance to rotation of the first gear wheel is reversible, to permit the machine to function in opposite rotational directions and thereby be used to exercise different muscles associated with the same joints, for example the biceps brachii and triceps brachii respectively.

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The invention will now be further described with reference to the accompanying drawings, which illustrate one preferred form of the exercise machine according to the present invention and wherein:-

25                    Fig. 1 is a detailed elevational view of the gear wheels and adjacent parts of the machine;

Fig. 2 is a diagrammatic isometric view showing the mechanism for applying a working load to the machine;

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Fig. 3 is an elevation from the side of the machine in use;

Fig. 4 is an end elevation in the direction of the arrow A of Fig. 3;

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Fig. 5 is a plan view in the direction of the arrow B of Fig. 3; and

Fig. 6 illustrates an exercise sequence using the exercise machine of Figs. 1 to 5.

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Referring firstly to Figs. 1 to 5 of the drawings, the illustrated exercise machine is built upon a tubular metal frame 10, within which are supported a seat 11, foot bars 12 and the exercise equipment now to be described. In the interests of clarity, the structural members by which the various components are mounted within the frame 10 have been omitted from the drawings.

20

Within the region of the shoulder joints of a person 13 sitting upon the seat 11, a pair of smaller gear wheels 14 are mounted for free rotation upon pivots 15. Secured coaxially to one face of the gear wheels 14, so as to rotate with the gear wheels upon the pivots 15, are two pulleys 16. Also pivoted at one of their ends upon the pivots 15, for free pivoting independently of the gear wheels 14 and pulleys 16, are two elongated links 17. The links 17 carry at their free ends two pivots 18, upon which a pair of larger gear wheels 19

are free to rotate.

The gear wheels 14 in the illustrated embodiment have approximately 40 gear teeth around their respective peripheries and the gear wheels 19 have approximately 60 such teeth. These 5 numbers represent one optimum mutual ratio but may be different for different machines, different users or different desired muscular developments. Drive chains 20 link the gear wheels 19 with the respective gear wheels 14.

A pair of arm levers 21 are secured to the respective gear 10 wheels 19 such that they may be used to rotate these gear wheels about the pivots 18. A hand grip 22 is provided at the free end of each arm lever 21.

Pulley wires 23 are each secured at one end thereof to one of the pulleys 16 and extend, via an assembly of further 15 pulleys best seen in Fig. 4, to a stack of weights 24. Thus the weights 24 resist rotation of the pulleys 16 and gear wheels 14 and thereby form the load against which the user must exercise his muscles.

As will be apparent, movement of the user's upper arms 20 about his shoulders causes the gear wheels 14 to rotate and thus lift (or lower) the weights 24. Movement of his lower arms about his elbows causes the gear wheels 19 to rotate and this rotation, via the drive chain 20, in turn rotates the gear wheels 14. Thus the resistance provided by the weights 24 25 operates against both the shoulder and the elbow joints and exercises the muscles associated with both joints, especially

the biceps, triceps and deltoids. The relative loadings on the two joints are determined by the relative sizes of the gear wheels 14 and 19.

Fig. 6 illustrates an exercise sequence using the illustrated exercise machine. An exercise primarily for developing the biceps begins in illustrated position C and entails moving the arms as shown, in a generally clockwise direction, via position B to position A, against the load provided by the weights 24. Development of the triceps is best achieved by the reverse sequence, that is by movement from position A to position C via position B. For this purpose, the direction of loading of the gear wheels 14 is reversed by changing the direction of wrapping of the wires 23 about the pulleys 16.

CLAIMS

1. An exercise machine comprising a support frame, a first gear wheel mounted for rotation about a first pivot which is fixed relative to the support frame, an elongated link pivoted in the region of one of its ends about said first pivot, a second gear wheel mounted for rotation about a second pivot in the region of the other end of said elongated link, drive means linking the peripheries of the first and second gear wheels, a lever to rotate said second gear wheel about the second pivot, and resistance means to apply a load opposing rotation of said first gear wheel.
2. An exercise machine as claimed in claim 1, having two said first and second gear wheels, elongated links and levers.
3. An exercise machine as claimed in either of claims 1 and 2, wherein said support frame is of generally open construction and is formed of tubular or angled frame members.
4. An exercise machine as claimed in any of the preceding claims, having a seat or other body support disposed within the frame and mounted thereon.
- 20 5. An exercise machine as claimed in claim 4, wherein the first pivot is located at a position upon the frame corresponding to the shoulder or hip of a user supported by said seat or other body support.

6. An exercise machine as claimed in any of the preceding claims, wherein the length of the elongated link, measured between said first and second pivots, is approximately equal to the length of the upper arm or upper leg respectively of a user of the machine.  
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7. An exercise machine as claimed in any of the preceding claims, wherein said drive means comprises a continuous flexible belt passing around the peripheries of the first and second gear wheels or an intermediate gear engaging both said gear wheels.
- 10 8. An exercise machine as claimed in any of claims 1 to 6, wherein said drive means comprises a drive chain, engaging teeth on the peripheries of the respective gear wheels.
9. An exercise machine as claimed in any of the preceding claims, wherein the length of the periphery of the second gear wheel is greater than that of the first gear wheel.  
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10. An exercise machine as claimed in claim 9, wherein the lengths of the peripheries of the second and first gear wheels respectively are in the approximate ratio of 1.5:1.
11. An exercise machine as claimed in any of the preceding claims, wherein the or each said lever is fitted with a hand grip or a foot bar at its free end.  
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12. An exercise machine as claimed in any of the preceding claims, wherein the resistance means is able to apply a variable load.

13. An exercise machine as claimed in any of the preceding claims, wherein the resistance means comprises a spring or is hydraulically or pneumatically operated.
14. An exercise machine as claimed in any of claims 1 to 12, 5 wherein the resistance means is in the form of one or more weights.
15. An exercise machine as claimed in any of the preceding claims, wherein the direction of resistance to rotation of the first gear wheel is reversible.
- 10 16. An exercise machine substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

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